

## CLAIMS

1. A data transmission system in which metallic structure of a pipeline system is used as a signal channel and earth is used as return, comprising:
- 5 current loop path forming apparatus, said current loop path for use in applying signals to the signal channel and earth return circuit, the loop having first and second conducting portions electrically connected to one another at a first location and electrically
- 10 connected to one another at a second location, the second location being spaced from the first location, and the metallic structure comprising at least one of the conducting portions; and
- a local unit having a transmitter for applying a
- 15 signal to one of the conducting portions, whereby in use a potential difference is generated between earth and the metallic structure in the region of the loop which causes a signal to be propagated along the signal channel provided by the metallic
- 20 structure away from the loop, wherein the loop forming apparatus is arranged to ensure that the spaced locations are separated by at least a minimum distance selected to give desired transmission characteristics.
- 25 2. A data transmission system according to Claim 1 in which the pipeline system comprises an inner flow line and a surrounding casing wherein, one conducting portion comprises a portion of the flow line and the other conducting portion comprises a surrounding
- 30 portion of the casing.
3. A data transmission system according to Claim 2 in which the loop forming apparatus comprises at least

one insulating spacer for keeping the flow line spaced from the surrounding casing for the selected minimum distance.

- 5 4. A data transmission system according to Claim 2 in which the spaced connections between the first and second conducting portions comprise glancing contacts between the flow line and casing beyond the selected region.
- 10 5. A data transmission system according to Claim 1 in which the local unit comprises a receiver for receiving incoming signals transmitted along the metallic structure.
- 15 6. A data transmission system according to Claim 5 in which the local unit is arranged to act as a relay station.
- 20 7. A data transmission system according to claim 1 in which the transmitter is arranged to apply signals substantially at the midpoint of the respective conducting portion.
- 25 8. A data transmission system according to claim 1 in which the transmitter comprises an isolation member disposed in series with the respective conducting portion and a signal generator connected across the isolation member.
- 30 9. A data transmission system according to claim 1 in which the transmitter means comprises an inductive coupling arrangement disposed around the respective

conducting portion.

10. A data transmission system according to Claim 1  
in which one conducting portion comprises a portion of  
5 one of a pipeline and a flowline and the other  
conducting portion comprises at least one electrically  
conductive elongate member connecting at least two  
pigs disposed within said one of a pipeline and a  
flowline and wherein the spaced connections to  
10 complete the current loop path are provided at the  
pigs.

11. A data transmission system in which metallic  
structure of a well including a production string and  
15 casing is used as a signal channel and earth is used  
as return comprising a local unit having at least one  
of receiving and transmitting means coupled to the  
string for respectively receiving signals from and  
transmitting signals along the signal channel, and  
20 insulating spacers arranged to ensure that the  
production string and casing are spaced from one  
another for at least a selected minimum distance in  
the region of the local unit, said minimum distance  
being selected to give at least one of desired  
25 reception and desired transmission characteristics.

12. A data transmission system according to claim 11  
in which the casing comprises a plurality of separate  
sections, and mating surfaces at at least one joint  
30 between adjacent sections are coated with an isolating  
medium.

13. A method of data transmission in which metallic

structure of a pipeline system is used as a signal channel and earth is used as return comprising the steps of:

- arranging a current loop path for use in applying  
5 signals to the signal channel and earth return  
circuit, the loop having first and second conducting  
portions electrically connected to one another at a  
first location and electrically connected to one  
another at a second location, the second location  
10 being spaced from the first location, and the metallic  
structure comprising at least one of the conducting  
portions;  
applying a signal to one of the conducting portions  
to generate a potential difference between earth and  
15 the metallic structure in the region of the loop and  
cause a signal to be propagated along the signal  
channel provided by the metallic structure away from  
the loop; and  
ensuring that the spaced locations are separated by at  
20 least a minimum distance selected to give desired  
transmission characteristics.

14. Signal receiving apparatus for use with a data  
transmission system in which metallic structure of a  
25 pipeline system is used as a signal channel and earth  
is used as return, comprising a local unit having a  
receiver, an arrangement for providing electrical  
contact between the local unit and at least two spaced  
locations on a portion of the metallic structure and  
30 an arrangement for ensuring that the two spaced  
locations are separated by at least a minimum distance  
selected to give desired reception characteristics,  
wherein said arrangement for providing electrical

contact include a first electrically conductive member portion for connecting the local unit to a first of the two locations and a second electrically conductive member portion for connecting the local unit to a  
5 second of the two locations.

15. A method for receiving a signal from the metallic structure of a pipeline system which is used as a signal channel in a data transmission system with  
10 earth as return, comprising the steps of providing a local unit having a receiver; providing electrical contact between the local unit and at least two spaced locations on a portion of the metallic structure, the electrical contact being provided via a first  
15 electrically conductive member portion for connecting the local unit to a first of the two locations and a second electrically conductive member portion for connecting the local unit to a second of the two locations; and ensuring that the spaced locations are  
20 separated by at least a minimum distance selected such to give desired reception characteristics.

16. A data transmission system for use in pipeline systems which transmission system comprises:  
25 apparatus for forming a current loop path comprising a portion of an inner conductive member and a corresponding portion of an outer conductive member electrically connected to one another at two spaced locations, the outer conductive member surrounding the  
30 inner conductive member and being part of the metallic structure of a pipeline system;  
an internal unit disposed within the outer member and having a transmitter for injecting a signal into the

loop; and

an external unit disposed outside the outer member and comprising an inductive coupling arrangement arranged to be linked by flux generated by current in the loop, the arrangement being such that in use the current  
5 flowing in said portion of the inner member does not match the current flowing in the corresponding portion of the outer member whereby signals are generated in the inductive coupling arrangement so allowing  
10 communication from the internal unit to the external unit.

17. A data transmission system according to Claim 16 in which the spaced locations are separated by at  
15 least a selected minimum distance chosen to give desired transmission characteristics.

18. A data transmission system according to Claim 16 which is arranged for use in a pipeline system  
20 comprising an inner conductive flowline and an outer conductive casing, said outer member comprising part of the casing and said inner member comprising part of the flowline.

19. A data transmission system according to Claim 18 in which the casing comprises a plurality of separate sections and mating surfaces at at least one joint  
25 between adjacent sections are coated with an isolating medium.

20. A data transmission system according to Claim 18 in which the electrical connections between the  
30 flowline and casing comprise at least one of glancing

contacts and conductive packers.

21. A data transmission system according to claim 16  
in which the apparatus for forming the loop comprises  
5 insulating spacer means.

22. A method of data transmission for use in pipeline  
systems which method comprises the steps of:  
forming a current loop path comprising a portion of an  
10 inner conductive member and a corresponding portion of  
an outer conductive member electrically connected to  
one another at two spaced locations, the outer  
conductive member surrounding the inner conductive  
member and being part of the metallic structure of a  
15 pipeline system;  
injecting a signal into the loop from an internal unit  
disposed within the outer member; and  
disposing an external unit outside the outer member  
which unit comprises an inductive coupling arrangement  
20 arranged to be linked by flux generated by current  
flowing in the loop,  
and the arrangement being such that the current  
flowing in said portion of the inner member does not  
match the current flowing in the corresponding portion  
25 of the outer member whereby signals are generated in  
the inductive coupling arrangement so allowing  
communication from the internal unit to the external  
unit.

30 23. A method of data transmission according to Claim  
22 in which the spaced locations are separated by at  
least a selected minimum distance chosen to give  
desired transmission characteristics.

24. Apparatus for use with a metallic structure to provide a system according to claim 1.

25. Apparatus for use with a metallic structure to carry out a method according to claim 13.

26. A data transmission system in which metallic structure of a pipeline system is used as a signal channel and earth is used as return comprising signal coupling loop forming apparatus, said loop having first and second conducting portions electrically connected to one another at spaced locations, the metallic structure comprising one of the conducting portions, and a local unit having a transmitter for applying a signal to one of the conducting portions whereby in use a potential difference is generated between earth and the metallic structure in the region of the loop which causes a signal to be propagated along the metallic structure away from the loop, wherein the loop forming apparatus is arranged to ensure that the spaced locations are separated by at least a minimum distance selected to give desired transmission characteristics and one conducting portion comprises a portion of an elongate deploying member which is arranged to move within and relative to a surrounding portion of metallic structure.

27. A data transmission system according to claim 26 in which the loop forming apparatus comprises at least one conductive centraliser arranged to keep the deployment member away from the surrounding portion of metallic structure for a predetermined minimum distance whilst also providing connection between the



conducting portions at one of the spaced locations.

28. A data transmission system according to claim 26  
in which the deployment member comprises coiled  
5 tubing.

29. A data transmission system according to claim 26  
in which the local unit comprises a receiver for  
receiving incoming signals transmitted along the  
10 metallic structure.

30. A data transmission system in which metallic  
structure of a well is used as a signal channel and  
earth is used as return, comprising an elongate  
15 deployment member arranged to move within and relative  
to a surrounding portion of metallic structure, a  
local unit supported on the deployment member and  
having at least one of a receiver and a transmitter  
coupled to the deployment member respectively for  
20 receiving signals from and transmitting signals along  
the signal channel, and at least one spacer arranged  
to ensure that the deployment member and the  
surrounding portion of metallic structure are spaced  
from one another for at least a selected minimum  
25 distance in the region of the local unit, said minimum  
distance being selected to give at least one of  
desired reception and desired transmission  
characteristics.

31. A method of data transmission in which metallic  
structure of a pipeline system is used as a signal  
channel and earth is used as return comprising the  
steps of:

arranging a signal coupling loop having first and second conducting portions electrically connected to one another at spaced locations, the metallic structure comprising the first the conducting portion, and a portion of an elongate deploying member which is arranged to move within and relative to a surrounding portion of metallic structure comprising the second conducting portion;

applying a signal to one of the conducting portions to generate a potential difference between earth and the metallic structure in the region of the loop and cause a signal to be propagated along the metallic structure away from the loop; and

ensuring that the spaced locations are separated by at least a minimum distance selected to give desired transmission characteristics.

32. Apparatus for use with a metallic structure to provide a system according to claim 26.

33. Apparatus for use with a metallic structure to carry out a method according to claim 31.

34. A system according to claim 26 in which signals may be transmitted as the deploying member is moving relative to the surrounding portion of metallic structure.

35. A method according to claim 31 in which signals may be transmitted as the deploying member is moving relative to the surrounding portion of metallic structure.

36. A data transmission system in which metallic structure of a pipeline system is used as a signal channel and earth is used as return, comprising means for forming a current loop path for use in applying  
5 signals to the signal channel and earth return circuit, the loop having first and second conducting portions electrically connected to one another at a first location and electrically connected to one another at a second location, the second location  
10 being spaced from the first location, and the metallic structure comprising at least one of the conducting portions, and a local unit having transmitting means for applying a signal to one of the conducting portions whereby in use a potential difference is  
15 generated between earth and the metallic structure in the region of the loop which causes a signal to be propagated along the signal channel provided by the metallic structure away from the loop, wherein the means for forming the loop is arranged to ensure that  
20 the spaced locations are separated by at least a minimum distance selected to give desired transmission characteristics.